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ABSTRACT

The study involving 54 learning disabled (LD) students (7 to 11 years old) and 54 regular class students (3 to 7 years old) investigated the developmental patterns for the comprehension of complex temporal references. Three types of stimulus sentences were designed to test the comprehension of temporal references employing the temporal conjunctions "before" and "after" in the main clause/subordinate clause structure: simple sequential (SS), reverse sequential (RS), and implicit event (IE) sentences. Based upon the sentences developed, six sets of pictures were produced with each set containing three pictures depicting everyday events. SS, RS, and IE sentences were presented with the six sets of stimulus pictures. Among findings was that the LD groups were highly variable in terms of the standard deviations and the range of scores in their performance. Some LD children are delayed in their mastery of comprehension skills and others are not. (SB)

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Comprehension of Temporal References in Normal and Learning Disabled Children

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Comprehension of Temporal References in Normal and Learning Disabled Children.

Introduction

Since temporal knowledge is of great import to children, recent research on language acquisition of both normal and learning disabled children has examined the comprehension of temporal references. Although clinical evidence indicates that learning disabled children are deficient in temporal reasoning and language skills (Hammill & Bartel, 1975; Wiig & Semel, 1976), research on their comprehension of temporal references is quite limited. Moreover, this research (Wiig & Semel, 1973, 1974) has been confined to the comprehension of single clause temporal references, while most research on temporal references in normal children has concerned the comprehension of complex sentence, employing the temporal conjunctions before and after. Since normal children generally have acquired the comprehension skills for complex temporal references by the early elementary school years (Clark, 1970; Harner, 1980), the comprehension of such temporal references should be examined in their learning disabled peers.

Temporal references, employing before and after in complex sentences, vary in terms of linguistic and cognitive demands on the comprehender. Two variations of the temporal references (simple sequential sentences and reverse sequential sentences) contain two explicit clauses, while the third variation (implicit event sentences) contains an explicit clause and an implicit clause represented by the citation of the agent.

The simple sequential sentences and reverse sequential sentences involve the ordering of two explicit events. In the simple sequential sentences, the linguistic order of the explicit clauses corresponds to the order of occurrence of the events; in the reverse sequential sentences, the linguistic order of the explicit clauses is the reverse of the order of occurrence. These temporal references are identical in meaning, but apparently not equivalent in difficulty for young children (Keller-Cohen, 1975). Normal children have frequently been shown to comprehend simple sequential sentences earlier than reverse sequential sentences (Bever, 1970; Clark, 1970, 1971; Ferreiro & Sinclair, 1971; Johnson, 1975). The earlier comprehension of simple sequential sentences has been attributed to the additional cognitive demand in reverse sequential sentences, that is, comprehension of the encoded order of events requires the manipulation of the order of the linguistic clauses (Goodwin, 1979).

The third variation, the implicit event sentences, involves the ordering an explicit clause and an implicit clause. Temporal references may involves one event fully described in the main clause and another event inferred from the implicit subordinate clause, as in "Mary throws the ball after John". However, research on the comprehension of complex temporal references (Harner, 1976, 1980) has employed temporal

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references containing an explicit subordinate clause and the citation of the agent which stands for the main clause. Rather than the ordering of two explicit events, the comprehension of implicit event sentences requires the identification of the implicit event as the "present" event, and the subsequent ordering of the implicit event in relation to the explicit event (Harner, 1976, 1980).

Although the normal language acquisition research on the comprehension of the complex temporal references, involving the temporal conjunctions before and after, has involved essentially the same linguistic form, the complex sntence, the comprehension of the three variations has not been directly compared. Moreover, the variations have been investigated by means of different tasks. While the comprehension of the simple sequential and reverse sequential sentence have been explored in an acting out task, the comprehension of implicit event sentences has been explored in research employing a picture selection task (Harner, 1980). This lack of direct comparison leaves to question of possibility of greater linguistic and cognitive demands in the comprehension of implicit event sentences.

Research on the comprehension of temporal references has also investigated the role of the context in normal language acquisition, by comparing the comprehension of logical and arbitrary temporal refernces (French & Brown, 1977). The semantic constraints in logical temporal references seemed to make one sequence more plausible than the other sequence, thereby reducing the demands on the comprehender. Children's superior comprehension of logical temporal references support the effect of contextual semantic restraints on comprehension. Although the context has been shown to be influential in normal acquisition of comprehension skills for temporal references and other linguistic forms (Bloom & Lahey, 1978), the role of the context has not been extensively explored in the research concerning the language acquisition of learning disabled children.

The purpose of this study is to investigate the developmental patterns for the comprehension of complex temporal references in normal and learning disabled children. Three specific research questions are examined. First, do the three variations pose differential linguistic and cognitive demands on the comprehender ? Second, does the context have a differential effect on the comprehension skills of the learning disabled children? Third, does the developmental pattern for comprehension in the learning disabled children correspond to that in normal children and to what extent are they delayed in their acquisition of the comprehension skills ?

Methodology

Subjects

The learning disabled students in this study were males enrolled in self contained special education classes in urban public schools. They had been previously identified as

learning disabled by school personnel according to state identification criteria which include: (a) normal intellectual potential as indicated by a full scale IQ above 85; (b) a significant discrepancy between functional achievement at or below 50% of expected achievement in at least two readiness or basic skills; and (c) exclusion of other handicapping conditions. Females were not included in this study because it was impossible to obtain a representative number at each of the three stage levels of interest. Because IQ scores and other school records were not available or accessible to this experimentor,0the subjects were selected on the basis of class placement.

Overlapping age ranges for normal (CA 3-7) and learning disabled children (CA 7-11) were selected for the following reasons: (1) Studies on normal children have shown that they learn how to comprehend temporal references in the main clause/subordinate clause structure between the ages of three and seven (Amidon & Carey, 1972, Harner, 1976). (2) Studies on language acquisition in learning disabled children have shown that they are delayed in their acquisition of linguistic forms and resemble normal younger children in their language development (Wiig & Semel, 1976).

The normal children were selected from regular class placements on the basis of teachers' recommendations that they did not demonstrate any learning difficulties. All of the children were Caucasians. They were native speakers of English and had parents who were also native speakers of English. The children were randomly selected from the total enrollment of the class placements according to age and type of class placement. Table 1 specifies the demographic information.

Table 1
Demographic Description of the Sample.

Class Placement	Number	Chronological Age	
		range	$\bar{X}$
Regular classes			
Young	18	3.5- 4.00	3.74
Middle	18	5.5- 5.11	5.82
Older	18	7.5- 8.00	7.76
Learning disabilities classes			
Young	18	7.4- 8.00	7.79
Middle	18	9.0-10.00	9.63
Older	18	11.2-11.10	11.75

Materials

Three types of stimulus sentences were designed to test the comprehension of temporal references employing the temporal conjunctions before and after in the main clause/subordinate clause structure: simple sequential (SS), reverse seuential

(RS) and implicit event (IE) sentences. Simple sequential sentences explicitly described two events in their order of occurence of the events. Reverse sequential sentences explicitly described two events in the reverse of the order of occurence of the events. Implicit event sentences contained an introduction to the stimulus sentence "Show me", the agent which stood for the implicit main clause and an explicit subordinate clause. Each of the three sentence types was designed to describe both logical and arbitrary sequences of events.

Sentence types

Sequence of the events in the pictorial presentation:
(1) Boy throws a stick
(2) Boy kicks a rock
(3) Boy pets a dog

Simple Sequential Sentences
(1) The boy throws a stick before he kicks a rock.
(2) After the boy kicks a rock, he pets a dog.

Reverse Sequential Sentences
(3) Before the boy kicks a rock, he throws a stick.
(4) The boy pets a dog after he kicks a rock.

Implicit Event Sentences
(5) (Show me) the boy before he kicks a rock.
(6) (Show me) the boy after he kicks a rock.

Based upon the sentences developed, six sets of pictures were produced. Each set contained three pictures depicting familiar, everyday events. Each line-drawn picture was presented on a 10 X 12 cm. white card. The pictures in each set depicted the same character in three events. Three sets of pictures involved logical sequences of events such as a girl putting on her sock, putting on her shoe and tying her shoelaces. The remaining three sets involved arbitrary sequences of events such as a boy tying his shoe, reading a book and opening the door.

A total of 36 stimulus sentences were presented to each child. Half of the stimulus sentences described logical sequences and the remaining half described arbitrary sequences. Two of sentence types, one containing before and the other containing after, were presented with each set of stimulus pictures. In this way, 12 simple sequential sentences, 12 reverse sequential sentences and 12 implicit event sentences were presented with the six sets of stimulus pictures. Given the systematic generation of the stmulus sentences, 18 of the stimulus sentences contained before and 18 of the stimulus sentences contained after.

The order of presentation was randomized within each set of pictures and within the sets of pictures. The logical and arbitrary sequences of pictures and each accompanying set of stimulus sentences were randomly presented. The restrictions on the order of presentation within each set of stimulus sentences were: (1) The order of the three variations employing before and after was randomized for each set of pictures. (2) No successive trial used the same stimulus sentence type or the

same temporal conjunction. (3) Each of the stimulus sentences occured once with each set of pictures. (4) One of each pair of simple sequential, reverse sequential and implict event sentences employed with each set of pictures involved the relationship between the events in the first and second pictures, while the other member of the pair involved the relationship between the events in the second and third pictures.

Procedures

Each child was tested individually for approximately thirty minutes. A demonstration set of pictures was used to test the child's knowledge of the left/right orientation for the pictorial representation of temporal sequences of events. The child were asked to sequence three pictures. Each child was asked to point to the first and last event. Exclusion from this study was based on the ability to sequence the three pictures independently and answer the questions about the order of events. Four children from the three-year-old normal group, six children from the seven-year-old learning disabled group and one child from the nine-year-old learning disabled group were excluded from the present study.

Following the demonstration set, the expermenter said, "Now we are going to play a game with some more pictures. I will tell you a story with these pictures. Then I will say something and you will show me which picture I am talking about". As the experimenter placed a set of pictures in a row going from left to right, she described the action of each picture using the present progressive tense. Then the experimenter said, "Now listen. Show me the picture I am talking about". Then she produces one of the stimulus sentences. The task involves the comprehension of the ordering the events in the linguistic presentation and the selection of the "present" event described in the main clause.

After the child's response, the experimenter presented each of the other five stimulus sentences related to that set of pictures, and then the other sets of stimulus material. If the child did not respond to the stimulus sentence, the experimenter repeated the stimulus sentence one time. The child received a brief nod after each response regardless of whether the response was correct or not. The criterion for successful comprehension was the selection of the picture of the "present" event described in the main clause or the implicit event in the stimulus sentence.

Results

The results were analyzed by a 2 (context dimensions: logical-arbitrary) X 3 (variations of temporal references: simple sequential, reverse sequential and implicit event sentences) X 2 (temporal conjunctions) X 3 developmental levels) X 2 (educational category: normal-learning disabled) multivariate repeated measures of variance. The variables in the temporal references, were significant regardless of

educational category and developmental levels (F (12,91) = 1,018, p .01). The order of comprehension of the three variations of temporal references from easiest to hardest was found to be (a) simple sequential sentences, (b) reverse sequential sentences, and (c) implicit event sentences (F (12, 91) = 152.56, p .01). Children comprehended significantly more simple sequential sentences than reverse sequential sentences (t = 5.68, p .001), and significantly more reverse sequential than implicit event sentences (t = 6.51, p .001). Children comprehended significantly more logical sentences than arbitrary sentences (F (12,91) = 24.89, p .01). However, the context dimension X the temporal reference variations interaction was not significant (F (12,91) = .27, p .05). The temporal references employing before were comprehended significantly better than the temporal references employing after (F (12,91) = 9.93, p .01).

Regardless of educational category (F (12,91) = 13.34, p .01), comprehension of the three variations of temporal references increases with age (F (12, 91) = 68.33, p .01). The five-year-old normal and the nine-year-old learning disabled children comprehended significantly more of each variation than the three-year-old normal and the seven-year-old learning disabled children, respectively (Dunn's d. for SS= 1.69, p .01, Dunn's d. for RS= 2.92, p .01, Dunn's d. for IE= 4.49, p .01), while the comprehension of the five-year-old and seven-year-old normal children and the nine-year-old and eleven year-old learning disabled children only differed in the case of the implicit event sentences (Dunn's d. = 1.73. p .05).

The developmental levels significantly interacted with the context dimension regardless of the educational category (F (12,91) = 14.98, p .01). However, only the children in the young groups comprehended significantly more logical sentences than arbitrary sentences (t = 2.68, p .01).

Planned comparisons were performed on the total comprehension and the comprehension of the temporal reference variations to compare the developmental patterns in normal and learning disabled children. Although the age ranges of the two populations varied by four years, the learning disabled children (CA 7-11) and the normal children (CA 3-7) comprehended a significantly similar total number of temporal references (F (12,91) = 1.65, p .05). The seven-year-old learning-disabled children comprehended the temporal references quite similarly to the three-year-old normal children and quite dissimilarly to the five-year-old and seven-year-old normal children. Likewise, the nine-year-old and eleven-year-old learning disabled children did not perform significantly different from either the five-year normal children or the seven-year-old normal children. In terms of the temporal reference variations, however, the non-significant results suggested that the nine-year-old and eleven-year-old learning disabled children comprehended slightly more reverse sequential and implicit event sentences than the five-year-old normal children, but slightly less of each variation than the seven-year-old normal children.

The slight differences in the developmental patterns in

terms of group performance may be due to the high variability in the learning disabled populations, as indicated by the standard deviations and the range of scores in their performance. Generally, the standard deviations for the performance of the learning disabled groups were higher for each temporal reference variation and for total comprehension than those for the groups of normal children. Slight deviations in this pattern were in the performance of the five-year-old normal children who performed very variably in their comprehension of implicit event sentences. The seven-year-old learning disabled group was the most variable group. Moreover, in each group of learning disabled children, at least one children scored at or near the ceiling (36 points). The ranges of scores for the learning disabled groups were generally larger than the range of scores in the normal groups.

Table 2
Means for total performance and ranges according to developmental level and educational category.

	Mean	S.D.	Range
Normal			
3 year olds	21.44	3.45	17 - 27
5 year olds	31.05	4.63	24 - 36
7 year olds	34.83	2.28	29 - 36
Learning Disabled			
7 year olds	23.50	6.18	15 - 35
9 year olds	32.11	4.43	23 - 36
11 year olds	33.17	3.47	23 - 36

Table 3
Differences between the total comprehension means and the variation mean scores according to developmental level and educational category (Dunn, 1961)

Developmental Levels		Variations			Total Comprehension
		SS	RS	IE	
LD	N	Diff.	Diff.	Diff.	Diff.
7	3	.72	-1.28	-1.50	2.06
7	5	2.33**	2.22**	3.00**	7.55**
7	3	2.44**	2.77**	6.11**	10.33**
9	5	.55	-.11	-1.50	1.05
9	7	.66	.44	1.61	2.72
11	5	.11	-.38	-1.83	2.11
11	7	.22	.16	1.27	1.67
Dunn's d at p .05*		d= 1.07	d= 1.45	d= 2.29	d= 4.01
at p .01**		d= 1.26	d= 1.72	d= 2.74	d= 4.73

Discussion

Learning disabled children may be delayed in their mastery of comprehension skills for temporal references up to six years, though they follow the same developmental pattern as normal children. The normal developmental pattern reflects the increasing complexity of the temporal reference variations. The proposed children's first strategy for the comprehension of temporal references, the "order of mention" strategy, is appropriate the comprehension of temporal references in which the linguistic presentation describes events in a direct order that is, simple sequential sentences. Due to the inappropriateness of the "order of mention" strategy, the indirect presentation in the reverse sequential sentences poses a greater demand on the comprehender's knowledge of the linguistic form and the temporal conjunctions and requires the more advanced cognitive ability of manipulating the order of the presented clauses than the simple sequential sentences.

In this first direct comparison of these variations of temporal references, children generally comprehended simple sequential and reverse sequential sentences earlier than implicit event sentences. Instead of the ordering two explicit events as in the comprehension of simple sequential and reverse sequential sentences, the comprehension of implicit events involves the ordering of an explicit event and an implicit or "unknown" event. In this picture selection study, the comprehension of implicit event sentences involves the selection of a picture whose description is not encoded in the linguistic presentation, and requires decentered responses (Cromer, 1971). In terms of the linguistic requirements for the comprehension of implicit event sentences and the task requirements, the comprehension of this variation of temporal references require the ability to decenter, which is not required in the comprehension of the simple sequential and reverse sequential sentences. Comprehension of implicit event sentences, whether in experimental tasks or in the natural situations, poses the greatest cognitive demands, the ability to make interpretions of intention of the message beyond the stated facts. Moreover, in this way, implicit event sentences pose the greatest demands of the comprehender's knowledge of the linguistic form and temporal conjunctions.

The normal developmental pattern for the comprehension of temporal references reflects the increasing cognitive and linguistic demands in the variations. The developmental pattern exhibited by the learning disabled children as groups resembled the normal developmental pattern, indicating a great delay in many of them. As the variations contained more cognitive and linguistic demands, the less competent comprehenders was less able to understand the temporal references. With age, the learning disabled children generally, as well as the normal children, acquired more cognitive and linguistic skills and comprehended the variations of temporal references better.

However, it is insufficient to say that seven-year-old learning-disabled children comprehended temporal references as

three-year-old normal children did, or that nine-year-old and eleven-year-old learning disabled children did not perform differly from either the five-year-old and seven year-old normal children. The learning disabled groups were highly variable in terms of the standard deviations and the range of scores in their performance. Some learning disabled children are delayed in their mastery of comprehension skills and others are not. At least, one learning disabled child at each age level comprehended the temporal references as well as most of the seven-year-old normal children. Moreover, at least one learning disabled child at each age level performed as poorly as the three-year-old normal children.

In addition, the normal developmental pattern shows the the role of the context in the acquistion of skills for the comprehension of temporal references. Younger children of each educational category comprehended more logical than arbitrary temporal references. With age, the children were less dependent on the context for their comprehension of temporal references. The effectiveness of the role of the context has been shown powerful in the language acquisition of learning disabled children.

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